of said stainless steel, said copper layer in contact with said zinc, wherein at least a portion of each of said three different metals are exposed at the peripheral edge surface of said anode casing, wherein said anode casing peripheral edge surface is plated with at least one layer of a protective metal comprising copper, thereby covering and preventing exposure of different metals at said peripheral edge surface.

REMARKS

Reconsideration is respectfully requested in view of the following remarks.

THE CLAIMS

Applicant affirms provisional election of Group I product claims 1-43. Thus process claims 44-47 presently stand withdrawn.

Claims 1-12 have been canceled. Dependent claims 14, 21-22, 24, 27, and 41-43 have been canceled.

Independent claim 13, drawn to a zinc/air cell, has been amended to reflect the preferred anode casing material comprising a triclad metal comprising stainless steel having a layer of nickel on its outside surface and a layer of copper on its inside surface. Claim 13 has been further amended to reflect a preferred protective metal, comprising tin, is applied to the peripheral edge surface of the anode casing to cover the exposed different (triclad) metals at said peripheral edge surface.

Dependent claim 35 has been amended to recite that the zinc particles comprise zinc alloyed with an alloy material comprising indium, lead, and aluminum. (Support in the specification appears at p. 33, lines 4-7)

A new independent claim 48 has been added. New claim 48 parallels claim 13 except that the tin protective layer for said peripheral edge surface has been replaced with copper. Thus, claim 48 recites that the a protective layer comprising copper is applied to the peripheral edge surface of the anode casing to cover exposed different (triclad) metals at said peripheral edge surface.

THE INVENTION

When the anode casing of a zinc/air alkaline cell is formed of a multiclad metal, for example a triclad of nickel/stainless steel/copper, the peripheral edge surface of the anode casing has exposed along its surface each of the individual different metals layers: nickel, stainless steel, and copper in close proximity to each other. That is, such different metal layers are exposed within the thickness of the anode casing peripheral edge surface, e.g. between about 0.001 inches and 0.015 inches (0.0254 mm and 0.38 mm). The close proximity of the exposed different metal layers along the anode casing peripheral edge surface produces electrochemical potential gradients when in contact with electrolyte. Such potential gradient can cause secondary electrochemical reactions which in turn can promote electrolyte creep along the outside surface of the anode casing, that is, between the anode and insulating seal. Such electrolyte creep can occur due to the exposure of different metals at the anode casing peripheral edge surface, despite the presence of tightly placed insulating seal material between the anode and cathode casing.

It has been determined that when the exposed different metal, e.g. the exposed different triclad metals, at the anode casing's peripheral edge surface are covered with a homogeneous protective metal coating, preferably of tin or copper, there is no potential gradient across the anode casing peripheral edge surface. Thus, the secondary reactions resulting from exposure

to different metals at the anode casing peripheral edge surface is eliminated and thus electrolyte creep resulting directly from such secondary reactions is also eliminated.

Applicant has carefully presented data in the present Application Tables 1 and 2 showing the marked reduction in electrolyte leakage resulting from cells with anode casing plated to cover the exposed nickel/stainless steel/copper layers at the peripheral edge surface. In specific examples these different exposed triclad layers were covered with a protective metal of tin or copper. The reduction in electrolyte leakage resulting from such covering of the exposed triclad layers was very significant. For example inspection of Table 1 reveals that at the end of 12 months there was noticeable electrolyte leakage in 96.9% of the mercury free comparative zinc/air cells (Group B) having anode casings of untreated nickel/stainless steel/copper triclad. By contrast only 0.3% of the Group E cells and 0.2% of the Group H cells showed leakage at the end of the 12 month period. The Group E cells had anode casing of triclad nickel/stainless steel/copper overcoated with a layer of tin to cover the exposed different triclad metals. The Group H cells had an anode casing of triclad nickel/stainless steel/copper overcoated with a layer of copper to cover the exposed different triclad metals.

<u>The Rejection</u>

Claims 1-6 were rejected as being anticipated by Wiacek (U.S. 4,014,211). Claim 1 is rejected under 35 USC 102(b) as being anticipated by JP 50-134137. (In JP '137 the anode can of an alkaline battery is composed of nickel plated iron. The rim part of the anode can including the peripheral edge surface is coated with a nickel oxide film. The nickel oxide film is said to prevent electrolyte leakage.)

Claim 1 is rejected under 35 USC 102(b) as being anticipated by JP 54-60424. (In JP '424 the anode can of an

alkaline battery is of steel which is plated with gold on the can's inside and outside surfaces including the peripheral edge surface. The anode can contains amalgamated zinc.)

Claims 2-23, 25, 26, 28, 29 and 31-40 are rejected under 35 USC 103(a) as being unpatentable over Mansfield (U.S. 5,306,580) in view of either JP '137 or JP '424 as applied to claim 1 above. (Mansfield discloses a zinc/air alkaline button cell wherein the anode can is if a triclad material, namely, steel with a layer of nickel on its outer surface and a layer of copper on its inside surface. A layer of indium is plated on the inside surface of the anode can and also on a portion of the outside surface of the anode can which abutting a plastic seal. However, Mansfield does not show indium, or any other protective metal, covering the exposed peripheral edge surface of the anode casing. Thus, as clearly shown in Mansfield's figure, each of the thrree triclad metals at the anode cup's peripheral edge surface are shown exposed to electrolyte.

Claims 24 and 27 are rejected under 35 USC 103(a) as being unpatentable over Mansfield ('580) in view of JP '137 as applied to claims 1-23, 25, 26, 28, 29 and 31-40. The Examiner maintains that the substitution of copper for the nickel oxide layer disclosed in JP '137 is an obvious substitution in recognition of copper's resistance to passivation and electrolyte attack.

Claim 30 (directed to the cup's wall thickness) is rejected under 35 USC 103(a) as being unpatentable over Mansfield '580 in view of either JP '137 or JP '424 as applied above and further in view of Jaggard (Re. 31,413). The Examiner indicates that Jaggard teaches an anode cup wall thickness of 0.010 inches, which is within Applicant's claimed range of between 0.001 and 0.015 inches.

Claims 41-43 (directed to application of an anticorrosive layer over the metal protective layer) are rejected under 35 USC

103(a) as unpatentable over Mansfield '580 in view of either Jp'137 or JP'424 as applied above and further in view of Gordon (U.S. 6,060,196). The Examiner indicates that Gordon teaches an anticorrosive coating on the outer layer of the anode casing for a zinc/air cell.

Discussion of the References

Wiacek (U.S. 4,041,211) discloses a zinc/air button cell with an anode can for anode material and a cathode can for catalytic cathode material. The anode can is described as preferably of copper clad stainless steel. There is no disclosure or suggestion of the use of an anode can formed of a triclad material. More specifically there is no contemplation of the use of a triclad material for the anode can. There is a plastic insulating seal 22 around the anode can. The anode can is filled and inserted into the cathode can so that the insulating material lies therebetween. Additionally, there is an elastomeric coating 44 applied to the exterior surfaces of the anode can so that the elastomeric coating comes between the anode can metal surface and the insulating seal 22. The elastomeric coating 44 as shown in the figures appears to also cover the peripheral exposed edge of the anode can. The elastomeric coating 44 affords an elastic film which permits differential expansion of the plastic seal 22 and the metal anode can without breaking the bond between the two surfaces. (col. 7, lines 45-50). This provides an effective seal against electrolyte leakage.

Mansfield (U.S. 5,306,580) discloses a zinc/air alkaline button cell wherein the anode can is if a triclad material, namely, steel with a layer of nickel on its outer surface and a layer of copper on its inside surface. There is a plastic insulating seal around the anode can. The anode can is filled and inserted into the cathode can so that the insulating material lies therebetween. There is also a layer of indium

over the copper layer so that the indium covers the inside surface portion of the anode can in contact with anode active material within the can. The edge of the anode can at the open end thereof is folded outwardly so that a portion of the outside surface of the anode can, that is, the portion abutting the plastic insulating seal has a portion of the indium layer facing and abutting the seal. Mansfield indicates that the triclad material for the anode cup works well for miniature cells with added mercury to the anode, but that increased gassing can be expected in such cells that are mercury free. (col. 2, lines 2-10). Increased gassing can of course reduce the useful service life of the cell. Mansfield indicates that the indium plating on the copper helps to extend service of mercury free cells. (col. 6, lines 42-46). However, it is interesting to note that none of Mansfield's figures show indium at the exposed peripheral edge surface of the anode can. Thus, in Mansfield's disclosure each of the different triclad metals comprising the anode cup remain exposed to alkaline electrolyte within the cell, since Mansfield is not concerned with providing any protection for the peripheral edge surface of the anode can. Specifically, there is no indication that Mansfield contemplates applying an indium coating (or any other protective coating) to such peripheral edge surface to cover the exposed triclad metals. Mansfield does not consider that there can be any meaningful adverse effect of having the triclad metals exposed to electrolyte at such peripheral edge surface of the anode can.

The Japanese patent publication JP 50134137 (JP '137) discloses a button alkaline cell having an HgO/graphite cathode with KOH electrolyte. The cell has an anode cup and a cathode cup with the anode cup inserted into the cathode cup. There is a Neoprene rubber alkali resistant insulator placed between the anode and cathode cups. The anode cup is composed of a multilayered metal, namely, nickel plated iron. The rim part (edge of the anode cup including the peripheral tip edge) is coated with a layer of Ni oxide film which was applied by

electrolytic oxidation. The figure shows that the nickel oxide film is applied to both the outside surface and inside surface of the rim edge part of the anode cup at the open end of the cup. The figure shows that the Ni oxide coating also covers the peripheral edge surface of the anode cup. Thus the Ni oxide would cover any exposed nickel and iron layers at the anode cup's peripheral edge surface. The Nickel oxide coating on the anode cup's rim edge is said to prevent electrolyte leakage from the cell.

The Japanese patent publication JP 54-60424 (JP '424) discloses an alkaline button cell having an anode cup inserted into a cathode cup. The anode cup is of steel construction 1 which is plated with gold 2. The steel anode cup appears to be plated with gold 2 on the inside and outside surfaces of the anode cup including its peripheral edge surface. There is no indication from the Abstract that the steel anode cup itself was of multiclad material before gold plating. There is a nylon insulator placed between the anode and cathode cups. The anode material comprises amalgamated zinc and the cathode material comprises a mixture of silver oxide and graphite. The cell comprises alkaline electrolyte. There is a separator of cellophane and nonwoven cellulosic material between anode and cathode. There is recited a sealant coating layer between the anode cup outer surface and the nylon insulator. Such sealant coating is not indicated to be of any metal. In fact "sealant" as the term is used in the electrochemical art, without further explanation, would normally be a polymeric, elastomeric, or asphalt coating and the like not a plated metal.

No.
An

Not in rejection / art not relied upon

The Japanese patent publication JP 53-084125 (JP'125) discloses an alkaline button cell having an anode cup inserted into a cathode cup with insulator material therebetween. The anode cup is filled with anode active material comprising zinc powder coated with indium. The anode cup is formed of a copper clad stainless steel. The anode cup surfaces are plated with

indium while electrosonic waves are applied to the plating bath. The anode cup may in turn also be coated with resin or oxides. The cathode cup comprises a body of silver oxide powder. The battery is said to resist electrolyte leakage.

Jaggard (Re.31413) discloses a zinc/air alkaline button cell having an anode cup inserted into a cathode cup with insulator placed therebetween. The anode cup is filled with zinc anode material. The cathode may comprise MnO2 which serves primarily to catalyze the air reduction reaction. The cathode cup edge is crimped over the insulator so that the cathode cup edge is interlocked over the anode cup edge with insulator therebetween. Jagaard does not indicate that the anode cup is composed of multilayered or multiclad metals. In any event Jaggard does not disclose or suggest coating the anode cup peripheral edge surface (or any other portion of the anode cup surface) with any other metal. The Examiner has cited Jaggard primarily for disclosing anode cup wall thickness of 0.010 (col. 6, line 48) which is within Applicant's range of between 0.001 and 0.015 inches as recited in claim 30.

Gordon (U.S. 6,060,196) discloses a zinc/air alkaline button cell having an anode cup inserted into a cathode cup with insulator seal therebetween. The anode cup is filled with zinc and gelled aqueous alkaline electrolyte. The cathode cup 10 is composed of nickel plated stainless steel. The anode cup body is composed of a zinc alloy material 1. The zinc alloy material is overcoated with a metallic outer layer 2 which can be of copper, tin or stainless steel. The outer layer protects the anode cup from corrosion. (col. 2, lines 63-65). Although there is a metallic protective layer 2 over the anode cup outside surface, it will be noted that the anode cup itself is not formed of a multiclad metal. Specifically the anode cup itself is formed of a homogeneous material, namely, a zinc alloy material. Thus there is no disclosure or suggestion in Gordon of overcoating any surface of an anode cup formed of a multiclad having

different metal layers. And more specifically there is no suggestion of overcoating the peripheral edge surface of an anode cup formed of a multiclad metal.

Arguments Against the Rejection

The claim sets 1-12 has been canceled, rendering moot the rejections against these claims. Dependent claims 14, 22, 24, 27, and 41-43 have been canceled, thus reducing the issues.

Independent claim 13 is directed to a zinc/air cell. Claim 13 has been amended to recite that the anode cup comprises a triclad comprising stainless steel with a layer of nickel on its outside surface and a layer of copper on its inside surface. Claim 13 recites that a protective metal comprising tin is plated onto the peripheral edge surface of said anode cup thereby covering the different triclad metals exposed at said peripheral edge surface. The above discussed data at Applicant's Table 1 shows marked reduction in electrolyte leakage resulting from application of the tin protective layer to cover exposed different triclad metals. Neither JP '137 nor JP '424 nor JP '125 discloses or suggests the application of a protective metal comprising tin to such multiclad anode can to cover exposed different metals at the can's peripheral edge surface as now recited in amended independent claim 13.

Mansfield shows a multiclad anode cup for a zinc/air cell which is plated with indium. However, as seen from Mansfield's figure or description there is no concern or contemplation to cover the exposed peripheral edge surface of the anode cup. Thus, as shown in Mansfield's figure the different triclad metals are left exposed at electrolyte at the anode can's peripheral edge surface. None of the other cited references including Wiacek '211 whether viewed alone or in combination with the Japanese references suggests the combination now recited in amended claim 1. Accordingly, amended claim 13 is

now believed to be patentable over the cited references. Withdrawal of the rejection of claim 13 under 35 USC 103 over Mansfield '508 in view of either 'JP'137 or JP' 424 is requested. Allowance upon reconsideration of amended claim 13 is respectfully solicited.

The claims depending from independent claim 13 reflect specific embodiments which further limit claim 13. These claims recite preferred ranges for cell size, wall thickness, and also extend the application of the protective metal to other portions of the anode casing surface in addition to the peripheral edge surface. Thus, the dependent claims, further restricting amended main claim 13 should be patentable if claim 13 is patentable. Claim 35, depending from claim 13, has been amended herein to recite that the zinc particles are alloyed with an alloy material comprising indium, lead, and aluminum. Amended claim 35 is believed to be specifically patentable, since none of the cited references discloses such alloy material for zinc.

New independent claim 48 parallels claim 13 except that the protective metal is recited as comprising <u>copper</u>. Although copper is also one of the recited triclad metals and it is known to use copper as a plating metal, for example, on the inside surface of an anode can, there is nevertheless no teaching in the cited art to apply copper to cover different exposed metals at the anode cup peripheral edge surface. As above stated Mansfield '508 leaves the triclad metals individually exposed to electrolyte at the anode cup's peripheral edge surface. The principal Japanese publications JP '137 and JP '424 do not disclose or suggest employing copper to cover different exposed metals at the anode cup's peripheral edge surface. Accordingly, it is believed that new claim 48 should also be patentable. The Examiner's consideration and allowance of new independent claim 48 is solicited.

Applicant encloses herewith a set of formal drawings

(4 sheets) for the subject application.

Applicant has made every effort to place the application in condition for allowance. A formal allowance upon the Examiner's reconsideration is solicited.

The undersigned attorney solicits a telephone call from the Examiner to clarify any questions which the Examiner may have concerning the application. Authorization is hereby given to debit Deposit Account 502271 for any amount owing or credit the same account for any overcharges in connection with this communication.

Date: June 26, 2003

Respectfully submitted,

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I certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450 on June 26, 2003.

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